

HR-308 Strengthening of Existing Continuous Span Steel Beam Concrete Deck Bridges by Post Tensioning

Key Words: Bridge strengthening, Post tensioning,

ABSTRACT

The need to upgrade a large number of understrength and obsolete bridges in the United States has been well documented in the literature. Through several Iowa DOT projects, the concept of strengthening simple span bridges by post-tensioning has been developed. The purpose of the project described in this report was to investigate the use of post-tensioning for strengthening continuous composite bridges. In a previous, successfully completed investigation, the feasibility of strengthening continuous, composite bridges by post-tensioning was demonstrated on a laboratory 1/3-scale-model bridge (3 spans: 41 ft 11 in. X 8 ft 8 in.). This project can thus be considered the implementation phase.

The bridge selected for strengthening was in Pocahontas County near Fonda, Iowa, on County Road N28. With finite element analysis, a post tensioning system was developed that required post-tensioning of the positive moment regions of both the interior and exterior beams. During the summer of 1988, the strengthening system was installed along with instrumentation to determine the bridge's response and behavior. Before and after post-tensioning, the bridge was subjected to truck loading (one or two trucks at various predetermined critical locations) to determine the effectiveness of the strengthening system. The bridge, with the strengthening system in place, was inspected approximately every three months to determine any changes in its appearance or behavior.

In 1989, approximately one year after the initial strengthening, the bridge was retested to identify any changes in its behavior. Post-tensioning forces were removed to reveal any losses over the one-year period. Post-tensioning was reapplied to the bridge, and the bridge was tested using the same loading program used in 1988. Except for at a few locations, stresses were reduced in the bridge the desired amount. At a few locations flexural stresses in the steel beams are still above 18 ksi, the allowable inventory stress for A7 steel. Although maximum stresses are above the inventory stress by about 2 ksi, they are about 5 ksi below the allowable operating stress; therefore, the bridge no longer needs to be load posted. Although considerably more involved than the post-tension strengthening of single-span bridges, post-tensioning of continuous-span bridges is a feasible practical strengthening technique.